

This listing of claims will replace all prior versions, and listings, of claims in the application.

**Listing of Claims:**

1. (previously presented) A peptide nucleic acid conjugate comprising:  
a backbone formed of amino alkyl amino acid monomeric units linked through amide bonds;  
said backbone having an amino end, a carboxyl end, a plurality of said amino alkyl amino acid monomeric units, and a conjugate bound directly or through a linking moiety to at least one of said amino end or said carboxyl end;  
each of said amino alkyl amino acid monomeric units having a tethered nucleobase;  
and  
said conjugate being a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, or a porphyrin.

2-4 (canceled)

5. (previously presented) A peptide nucleic acid conjugate comprising:  
a backbone formed of amino alkyl amino acid monomeric units linked through amide bonds;  
said backbone having an amino end, a carboxyl end, a plurality of said amino alkyl amino acid monomeric units,  
each of said amino alkyl amino acid monomeric units having a tethered nucleobase;  
and  
a conjugate bound to one of said nucleobases or its said tether either directly or through a linking moiety, wherein said conjugate is a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal

chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers.

6-7 (canceled)

8. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein said conjugate includes a linking moiety.

9. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein at least one group R<sup>12</sup> is a conjugate.

10. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein at least one of L and L<sub>m</sub> is R<sup>12</sup>(R<sup>13</sup>), is a conjugate.

11. (canceled)

12. (previously presented) A peptide nucleic acid conjugate of claim 54 wherein at least one of said A-A<sub>m</sub> groups include at least one of R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup>.

13. (previously presented) A peptide nucleic acid conjugate of claim 54 wherein at least one of B-B<sub>m</sub> groups or said G-G<sub>m</sub> groups include at least one group R<sup>3</sup>.

14. (canceled)

15. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein at least one of said groups Q or I include at least one of groups R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, and R<sup>11</sup>.

16-19 (canceled)

20. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein m is from 1 to about 20.

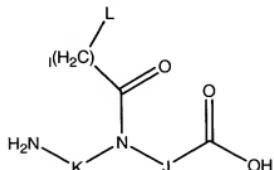
21-22 (canceled)

23. (previously presented) A peptide nucleic acid conjugate of claim 62 wherein R<sup>12</sup> is a conjugate.

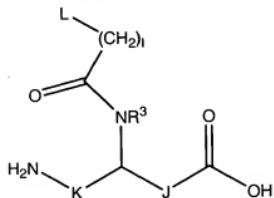
24. (previously presented) A peptide nucleic acid conjugate of claim 62 wherein a is 1.

25-29 (canceled)

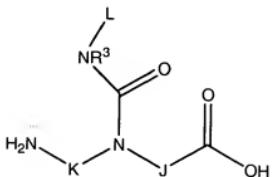
30. (previously presented) A peptide nucleic acid conjugate oligomer comprising a plurality of covalently linked PNA monomers wherein at least one of said PNA monomers has the formula:



or the formula



or the formula



wherein:

L is  $R^{12}(R^{13})_z$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1$ - $C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate;

provided at least one  $R^{12}$  and  $R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ ) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1$ - $C_6$ ) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

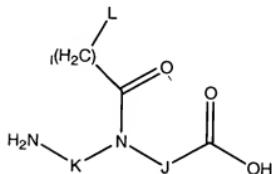
at least one of L and R<sup>3</sup> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;  
wherein said conjugate optionally includes a linking moiety.

31. (original) A peptide nucleic acid conjugate of claim 30 wherein said conjugate includes a linking moiety.

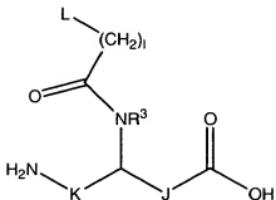
32. (previously presented) A peptide nucleic acid conjugate of claim 30 wherein a is 1.

33-46 (canceled)

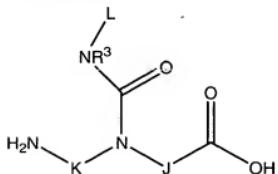
47. (previously presented) A peptide nucleic acid conjugate oligomer comprising a plurality of covalently linked PNA monomers wherein at least one of said PNA monomers has the formula:



or the formula



or the formula



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1$ - $C_4$ )alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ )alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio-substituted  $(C_1-C_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

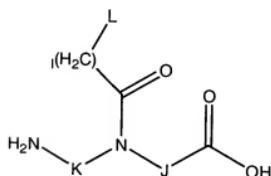
$l$  is an integer from 1 to 5; and

at least one of L and  $R^3$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

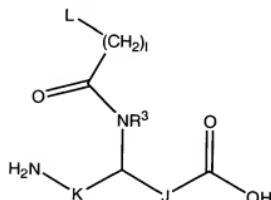
wherein said conjugate optionally includes a linking moiety; and

wherein at least one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ , and  $R^7$  is a conjugate.

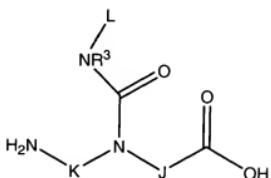
48. (previously presented) A peptide nucleic acid conjugate oligomer comprising a plurality of covalently linked PNA monomers wherein at least one of said PNA monomers has the formula:



or the formula



or the formula



wherein:

$\text{L}$  is  $\text{R}^{12}(\text{R}^{13})_a$ ; wherein:

$\text{R}^{12}$  is hydrogen, hydroxy, ( $\text{C}_1\text{-C}_4$ )alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $\text{R}^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$\text{R}^{13}$ , if present, is a conjugate; and

$a$  is 0 or 1;

$\text{K}$  is  $(\text{CR}^6\text{R}^7)_z$ ;

$\text{J}$  is  $(\text{CR}^6\text{R}^7)_y$ ; wherein:

$\text{R}^6$  and  $\text{R}^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $\text{C}_2\text{-C}_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $\text{C}_1\text{-C}_6$ ) alkoxy, ( $\text{C}_1\text{-C}_6$ ) alkylthio, a conjugate,  $\text{NR}^3\text{R}^4$  and  $\text{SR}^5$  or  $\text{R}^6$  and  $\text{R}^7$  taken together complete an alicyclic or heterocyclic system;

$\text{R}^3$  and  $\text{R}^4$  independently are hydrogen, a conjugate, ( $\text{C}_1\text{-C}_4$ )alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $\text{C}_1\text{-C}_4$ )alkyl, hydroxy, alkoxy, alkylthio or amino;

$\text{R}^5$  is hydrogen, a conjugate, ( $\text{C}_1\text{-C}_6$ )alkyl, hydroxy-, alkoxy-, or alkylthio-substituted ( $\text{C}_1\text{-C}_6$ )alkyl;

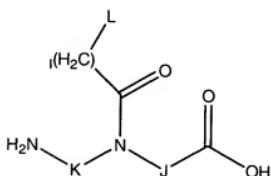
each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$l$  is an integer from 1 to 5; and

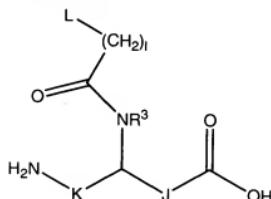
at least one of L and R<sup>3</sup> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and  
wherein at least one of said group K or said group J includes a conjugate.

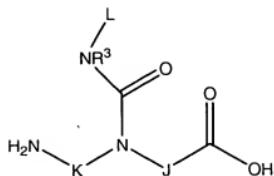
49. (previously presented) A peptide nucleic acid conjugate oligomer comprising a plurality of covalently linked PNA monomers wherein at least one of said PNA monomers has the formula:



or the formula



or the formula



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1$ - $C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ ) alkyl, hydroxy-, alkoxy-, or alkylthio-substituted ( $C_1$ - $C_6$ ) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

at least one of L and  $R^3$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a

cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

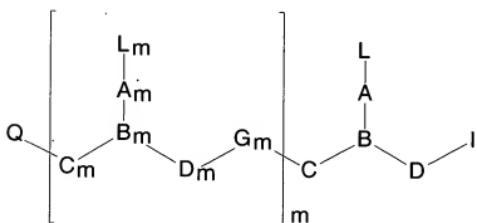
wherein said conjugate optionally includes a linking moiety; and  
wherein said group  $R^3$  is a conjugate.

50 (canceled)

51. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein one of Q or I comprises a conjugate, wherein said conjugate is polylysine.

52. (previously presented) A peptide nucleic acid conjugate of claim 53 wherein one of A,  $A_m$ , L or  $L_m$  comprises a conjugate, wherein said conjugate is polylysine.

53. (previously presented) A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and  $L_m$  independently are  $R^{12}(R^{13})_a$  wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1$ - $C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate;

provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate;

provided at least one  $R^{12}$  and  $R^{13}$  is a conjugate; and

$a$  is 0 or 1;

$C$  and  $C_m$  independently are  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ ) alkyl, hydroxy-, alkoxy-, or alkylthio-substituted ( $C_1$ - $C_6$ ) alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$D$  and  $D_m$  independently are  $(CR^6R^7)_z$ ;

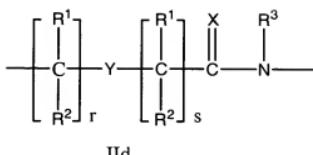
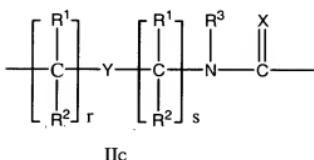
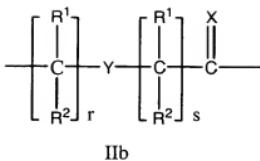
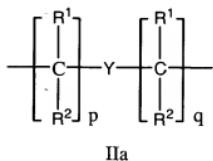
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IID) and  $B$  or  $B_m$  is  $CH$ ;



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

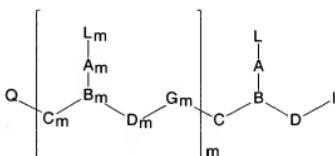
wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety.

54. (previously presented) A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and L<sub>m</sub> independently are R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub> wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate;

provided that at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

R<sup>13</sup>, if present, is a conjugate; and

a is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>)

alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio-substituted  $(C_1-C_6)$ alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino;

$D$  and  $D_m$  independently are  $(CR^6R^7)_z$ ;

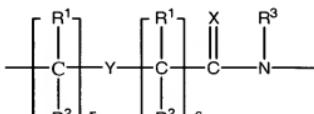
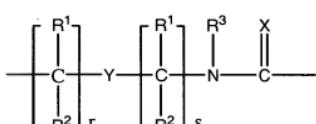
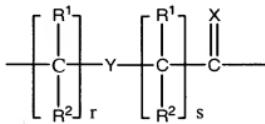
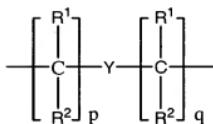
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IID) and  $B$  or  $B_m$  is  $CH$ ;



wherein:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen, ( $C_1$ - $C_4$ )alkyl, hydroxy-substituted ( $C_1$ - $C_4$ )alkyl, alkoxy-substituted ( $C_1$ - $C_4$ )alkyl, alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is  $-NR^8R^9$  or  $-NR^{10}C(O)R^{11}$ ; wherein:

$R^8$ ,  $R^9$ ,  $R^{10}$  and  $R^{11}$  independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is  $-CO_2H$ ,  $-CO_2R^8$ ,  $-CO_2R^9$ ,  $-CONR^8R^9$ ,  $-SO_3H$ ,  $-SO_2NR^{10}R^{11}$  or an activated derivative of  $-CO_2H$  or  $-SO_3H$ ; and

wherein:

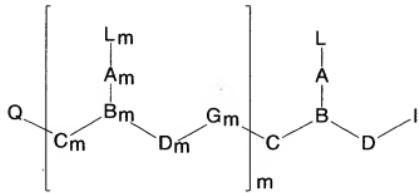
at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A,  $A_m$ , L, and  $L_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of  $R^1$ ,  $R^2$  or  $R^3$  is a conjugate.

55. (previously presented) A peptide nucleic acid conjugate of the formula:



wherein:

$m$  is an integer from 1 to about 50;

$L$  and  $L_m$  independently are  $R^{12}(R^{13})_a$  wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ )alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate;

provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

$a$  is 0 or 1;

$C$  and  $C_m$  independently are  $(CR^6R^7)_j$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2-C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1-C_6$ ) alkoxy, ( $C_1-C_6$ ) alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate, ( $C_1-C_6$ ) alkyl, hydroxy-, alkoxy-, or alkylthio-substituted ( $C_1-C_6$ ) alkyl; and

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1-C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1-C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

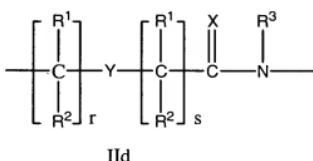
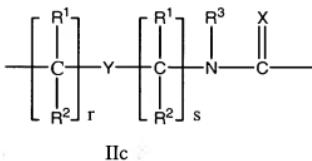
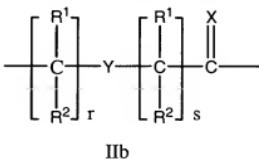
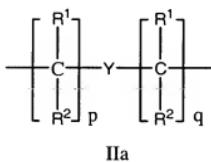
$D$  and  $D_m$  independently are  $(CR^6R^7)_z$ ;

each of y and z is zero or an integer from 1 to 10, wherein the sum y + z is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is  $N$  or  $R^3N^+$ ; or  
(b)  $A$  or  $A_m$  is a group of formula (IId) and  $B$  or  $B_m$  is  $CH$ ;



wherein:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of  $r$  and  $s$  is zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen,  $(C_1-C_4)alkyl$ , hydroxy-substituted  $(C_1-C_4)alkyl$ , alkoxy-substituted  $(C_1-C_4)alkyl$ , alkylthio-substituted  $(C_1-C_4)alkyl$ , hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

$I$  is  $-NR^8R^9$  or  $-NR^{10}C(O)R^{11}$ ; wherein:

$R^8$ ,  $R^9$ ,  $R^{10}$  and  $R^{11}$  independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is  $-\text{CO}_2\text{H}$ ,  $-\text{CO}_2\text{R}^8$ ,  $-\text{CO}_2\text{R}^9$ ,  $-\text{CONR}^8\text{R}^9$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{SO}_2\text{NR}^{10}\text{R}^{11}$  or an activated derivative of  $-\text{CO}_2\text{H}$  or  $-\text{SO}_3\text{H}$ ; and

wherein:

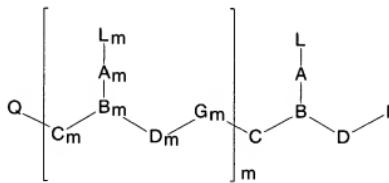
at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A,  $\text{A}_m$ , L, and  $\text{L}_m$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of  $\text{R}^8$ ,  $\text{R}^9$ ,  $\text{R}^{10}$  and  $\text{R}^{11}$  is a conjugate.

56. (previously presented) A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and  $\text{L}_m$  independently are  $\text{R}^{12}(\text{R}^{13})_a$  wherein:

$\text{R}^{12}$  is hydrogen, hydroxy,  $(\text{C}_1\text{-C}_4)$  alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate;

provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and  
a is 0 or 1;

C and  $C_m$  independently are  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid,  $(C_2-C_6)$  alkyl, aryl, aralkyl, heteroaryl, hydroxy,  $(C_1-C_6)$  alkoxy,  $(C_1-C_6)$  alkylthio, a conjugate,  $NR^3R^4$ ,  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

wherein  $R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$  alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$  alkyl; and

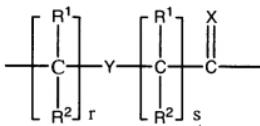
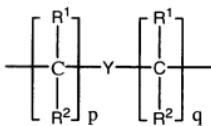
$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)$  alkyl, hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)$  alkyl, hydroxy, alkoxy, alkylthio or amino;

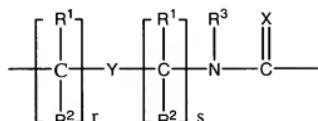
D and  $D_m$  independently are  $(CR^6R^7)_z$ ;  
each of y and z is zero or an integer from 1 to 10, wherein the sum y + z is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  
 $-NR^3SO_2-$  in either orientation;

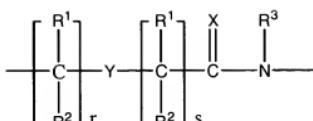
each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

- A or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and B or  $B_m$  is N or  $R^3N^+$ ; or
- A or  $A_m$  is a group of formula (IID) and B or  $B_m$  is CH;





IIc



IIId

wherein:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate; Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

wherein:

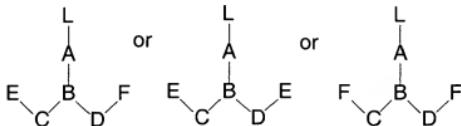
at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup> and R<sup>7</sup> is a conjugate.

57. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

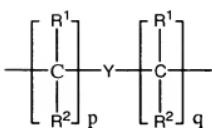
$R^{12}$  is hydrogen, hydroxy, ( $C_1$ - $C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

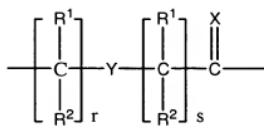
a is 0 or 1;

A and B are selected such that:

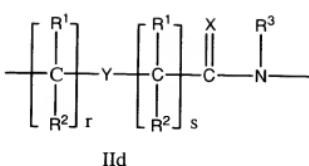
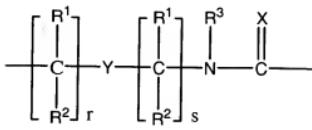
- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IId) and B is CH;



IIa



IIb



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and

R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio-substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

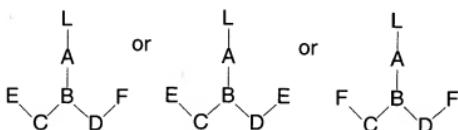
E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

wherein said conjugate optionally includes a linking moiety; and  
wherein at least one group R<sup>3</sup> is a conjugate.

58. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is R<sup>12</sup>(R<sup>13</sup>); wherein:

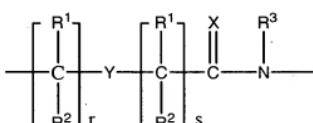
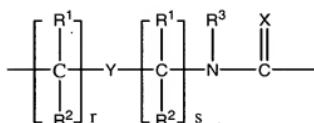
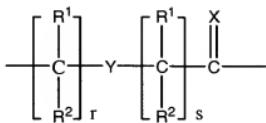
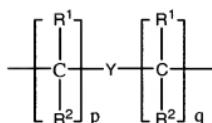
R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

R<sup>13</sup>, if present, is a conjugate; and

a is 0 or 1;

A and B are selected such that:

- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen, ( $C_1$ - $C_4$ )alkyl, hydroxy-substituted ( $C_1$ - $C_4$ )alkyl, alkoxy-substituted ( $C_1$ - $C_4$ )alkyl, alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is  $(CR^6R^7)_y$ ;

D is  $(CR^6R^7)_z$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ )alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio or amino; and

$R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ )alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1$ - $C_6$ )alkyl;

each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$E$  independently is  $COOH$ ,  $CSOH$ ,  $SOOH$ ,  $SO_2OH$  or an activated or protected derivative thereof;

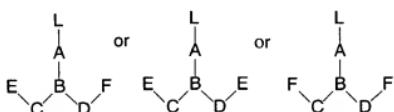
$F$  independently is  $NHR^3$  or  $NPgR^3$ , where  $Pg$  is an amino protecting group; or  $F$  comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of  $A$  and  $L$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups  $A$  or said groups  $B$  include a conjugate.

59. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

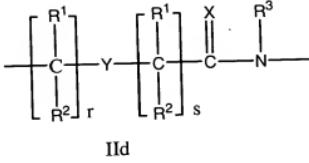
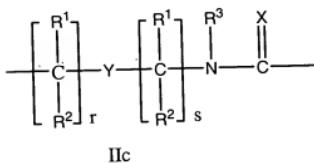
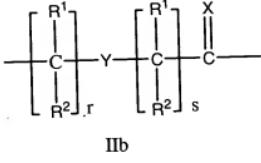
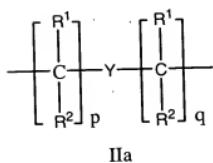
$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ )alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

$a$  is 0 or 1;

A and B are selected such that:

- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and

R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPGR<sup>3</sup>, where Pg is an amino protecting group; or

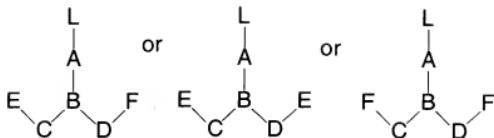
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of group R<sup>1</sup> or group R<sup>2</sup> is a conjugate.

60. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

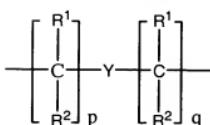
$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

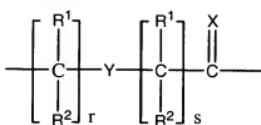
a is 0 or 1;

A and B are selected such that:

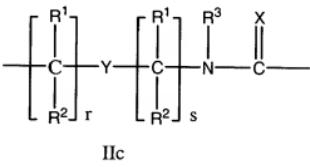
- A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- A is a group of formula (IId) and B is CH;



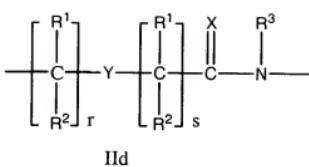
IIa



IIb



IIc



IIId

where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and

R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

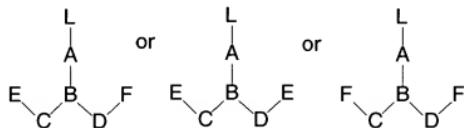
F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, or a porphyrin; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

wherein said conjugate optionally includes a linking moiety; and  
wherein at least one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, and R<sup>7</sup> is a conjugate.

61. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub>; wherein:

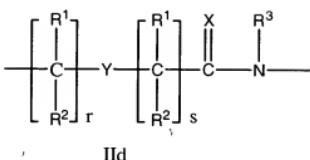
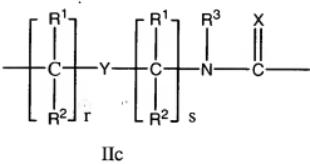
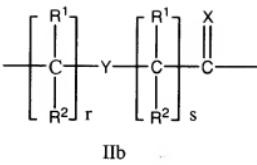
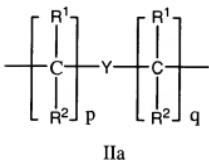
R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

R<sup>13</sup>, if present, is a conjugate; and

a is 0 or 1;

A and B are selected such that:

- A is a group of formula (IIa), (IIb) or (IIc) and B is N or R<sup>3</sup>N<sup>+</sup>; or
- A is a group of formula (IId) and B is CH;



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and

R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio-substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

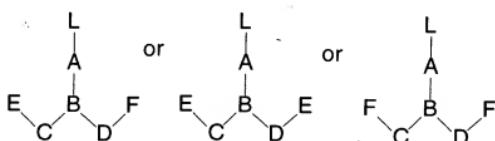
each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups C or said groups D include a conjugate.

62. (previously presented) A peptide nucleic acid conjugate comprising a plurality of monomers of formula:



wherein:

L is R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub>; wherein:

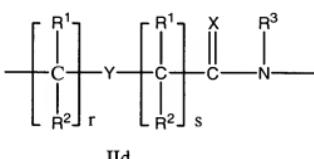
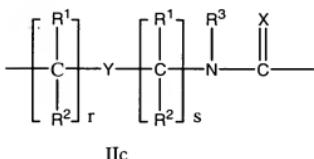
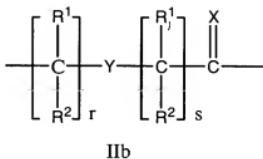
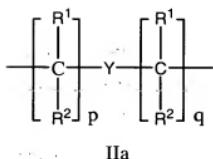
R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, or a nucleobase-binding group;

$R^{13}$ , if present, is a conjugate; and

a is 0 or 1;

A and B are selected such that:

- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IId) and B is CH;



where:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

$R^1$  and  $R^2$  independently are hydrogen, ( $C_1$ - $C_4$ )alkyl, hydroxy-substituted ( $C_1$ - $C_4$ )alkyl, alkoxy-substituted ( $C_1$ - $C_4$ )alkyl, alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is  $(CR^6R^7)_y$ ;

D is  $(CR^6R^7)_z$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ )

alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate,  $(C_1-C_4)alkyl$ , hydroxy- or alkoxy- or alkylthio-substituted  $(C_1-C_4)alkyl$ , hydroxy, alkoxy, alkylthio or amino; and

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)alkyl$ , hydroxy-, alkoxy-, or alkylthio-substituted  $(C_1-C_6)alkyl$ ;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is  $COOH$ ,  $CSOH$ ,  $SOOH$ ,  $SO_2OH$  or an activated or protected derivative thereof;

F independently is  $NHR^3$  or  $NPgR^3$ , where Pg is an amino protecting group;  
or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, or a porphyrin; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and

wherein said conjugate optionally includes a linking moiety.